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A NEW β CEPHEI STAR IN HARVARD STANDARD REGION E4

The star Q.81 in Harvard Standard Region E4 (HD78616), frequently used as a "standard star", was found to be variable by T Lloyd Evans in 1980. This had been suspected (Cousins & Stoy 1962) but had not previously been confirmed. The spectral type is B2 II/III (Houk, 1978). The following observations indicate that the star is β Cephei type variable.

The star was intensively observed in 1981 by Laing (at Sutherland) and Cousins (at Cape Town) using E region standards as comparison stars. The individual light curves pointed to a period of about 5 hours, but as the amplitude is small (0.05 mag) and the light curve seemed to vary in shape it was difficult to define the period precisely.

A periodogram of the 1981 observations gave 4.636 d^{-1} as the most probable reciprocal period, with an uncertainty of $\pm 0.001 \text{ d}^{-1}$. By including more recent observations (1981 Nov and 1982 Mar, Apr) this could be refined to $4.6361 \pm 0.0001 \text{ d}^{-1}$ ($P = 0.21570 \text{ d}$). The aliases, ± 1 cycle per day and ± 1 per year can be eliminated because they produce phase shifts as functions of U.T. or J.D. After whitening this material, by removing the fundamental period and its harmonics, the periodogram shows no evidence of a secondary period.

A mean light curve has been derived from the 1981 and 1982 V observations by Fourier analysis and these are shown together in Figure 1.

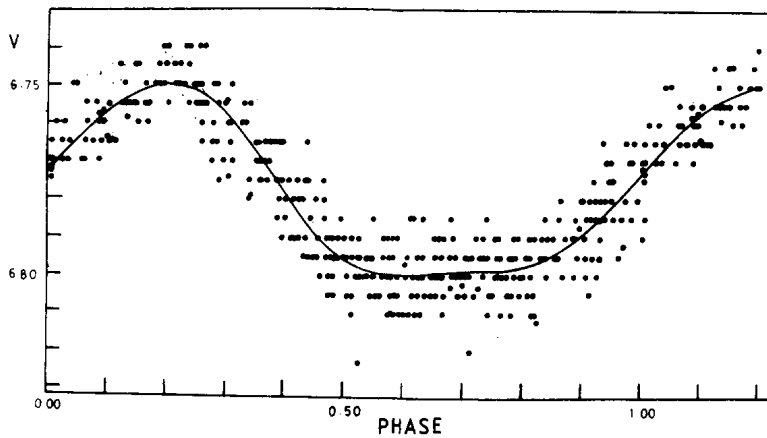


Figure 1. V magnitudes and light curve of E4-81 plotted against phase = 4.63611 (JD -2440000). The light curve is a third order Fourier fit to the observations.

There is a large phase error when the above period is extended back to 1980, but the 1980 and 1981 observations can be reconciled by adopting $p^{-1} = 4.6351 \pm 0.0002$. This is compatible with the 1981 period but is not acceptable for later observations, and the period is evidently variable. A quadratic ephemeris (with the period increasing at a rate of about 0.0004 d per year) would describe the phase changes from 1978 to 1982 but is not acceptable for earlier observations.

There is no significant change in the colour of this star accompanying the light changes, the mean values being $B-V = -0.^m002$, $U-B = -0.^m752$ (1981 observations), $V-R_c = 0.024$, $V-I_c = 0.023$ (Cousins 1980). The star is a close visual binary with nearly equal components so the true range of variation will be about twice the observed value. The colours imply that these stars are somewhat reddened.

One of the comparison stars used in 1981, E4-40 (= HD79416, B8V(pSi)) was found to be a micro-variable with night-to-night changes of one or two hundredths of a magnitude, necessitating a re-reduction of the observations of E4-81. This star will be discussed in a separate note.

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